DIESEL DIRECT INJECTION SYSTEM, SERVICING

The diesel direct injection system control module is equipped with a fault memory. Check the fault memory before/after performing repairs or adjustments, See **ENGINE CONTROL MODULE (DTC) MEMORY, READING AND ERASING** .

Safety precautions, See **SAFETY PRECAUTIONS** .

Rules for cleanliness, See **RULES FOR CLEANLINESS** .

SAFETY PRECAUTIONS

CAUTION: When performing repair work, especially due to the confined conditions in the engine compartment, pay attention to the following:

- **Route all types of hoses/lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum) as well as electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

To prevent injuries to persons and/or damage to the fuel injection and glow plug system, observe the following:

- The ignition must be switched off before connecting or disconnecting the glow plug system or injection system wiring or tester cables.
- If the engine is to be turned over at starter speed without starting, e.g. for compression pressure test, separate connection for injector unit at cylinder head.
- Before disconnecting the battery Ground (GND) strap obtain the code for radios with anti-theft coding.
- Disconnecting and connecting the battery must only be done with the ignition switched off, otherwise the diesel direct injection system control module could be damaged.

Observe the following if test and measuring instruments are required during a road test:

- Test and measuring instruments must be secured to rear seat and operated by an assistant from this location.

If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

RULES FOR CLEANLINESS

When working on the fuel supply/injection system, pay careful attention to the following rules:

- Thoroughly clean all unions and adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Only install clean components:

  Only unpack replacement parts immediately prior to installation.

  Do not use parts that have been stored loose (e.g. in tool boxes etc.).

- When system is open:

  Do not work with compressed air if this can be avoided.

  Do not move vehicle unless absolutely necessary.

- Make sure that no diesel fuel runs onto the coolant hoses. Immediately clean any accidental hose contamination. Affected hoses must be replaced.

DIESEL DIRECT INJECTION SYSTEM, COMPONENT LOCATIONS OVERVIEW

NOTE: The following list refers to items in Fig. 1 . The components A to C are not shown on the illustration.

A. **Brake Pedal Switch (cruise control/Diesel Direct Fuel Injection) -F47-**
   - In footwell on brake pedal

B. Brake light switch -F-
   - In footwell on brake pedal

C. **Throttle Position (TP) sensor -G79-**
   - In footwell on accelerator pedal

NOTE: The following list refers to items in Fig. 1 .

1. **Engine Coolant Temperature (ECT) sensor -G62-**
   - For engine control module.
   - With Engine Coolant Temperature (ECT) Sensor -G2-
   - If necessary, release pressure in cooling system before removing.
2. **Intake manifold flap**
   - With Motor for intake flap -V157-
3. **EGR Vacuum Regulator Solenoid Valve -N18-**
4. **Positive Crankcase Ventilation (PCV) Heating Element -N79-**

5. **Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248-**
    - With Barometric Pressure (BARO) Sensor -F96-
    - Replacing, See **ENGINE CONTROL MODULE**
6. **Intake Manifold Runner Control (IMRC) Valve -N316-**
7. **Exhaust Gas Recirculation (EGR) Cooler Switch-over Valve -N345-**
8. **Wastegate Bypass Regulator Valve -N75-**
9. **Mass Air Flow (MAF) Sensor -G70-**
10. **Connector**
    - For injector unit (-N240- to -243-)
11. **Engine Speed (RPM) Sensor -G28-**
12. **Fuel Temperature Sensor -G81-**
13. **Connector**
    - For Engine Speed (RPM) Sensor -G28-
14. **Connector**
    - For Camshaft Position (CMP) Sensor -G40-,
15. **Camshaft Position (CMP) Sensor -G40-**
    - For camshaft position
16. **Manifold Absolute Pressure (MAP) Sensor -G71- with Intake Air Temperature (IAT) Sensor -G72-**

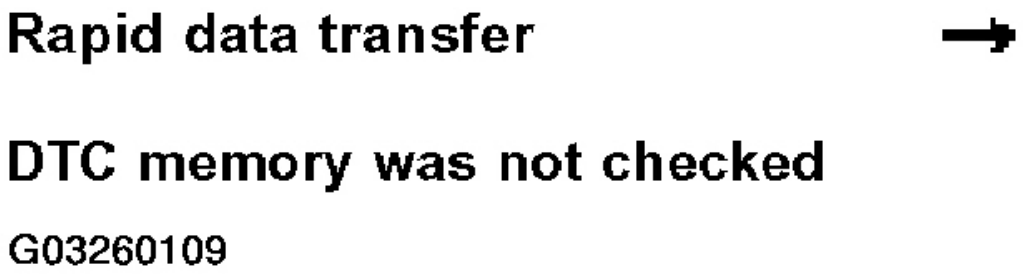

Fig. 1: Diesel Direct Injection System Component Locations Overview
Courtesy of VOLKSWAGEN OF AMERICA, INC.

VARIABLE INTAKE MANIFOLD, SERVICING

The variable intake manifold is switched depending on engine speed and accelerator pedal position.

NOTE: The following list refers to items in Fig. 2 .

1. **22 N.m**
2. **Connecting pipe**
   - From cooler for exhaust gas recirculation. See **EXHAUST GAS RECIRCULATION SYSTEM COMPONENTS, REMOVING AND INSTALLING** .
3. **Seal**
   - Always replace
4. **Intake manifold upper part**
5. **O-ring**
   - Always replace
6. **EGR Vacuum Regulator Solenoid Valve -N18-**
7. **10 N.m**
8. **O-ring**
   - Always replace
9. **Intake manifold flap**
   - With Motor for intake flap -V157-
10. **10 N.m**
11. **Seal**
    - Always replace
12. Seal
    - Always replace.
13. **Intake manifold lower part**
    - with selector shaft
14. **10 N.m**
    - Note tightening sequence. See **VARIABLE INTAKE MANIFOLD, DISASSEMBLING AND ASSEMBLING**
15. **Bracket**
16. **10 N.m**
17. **Vacuum actuator**
18. **Vacuum hose**
19. **Intake Manifold Runner Control (IMRC) Valve -N316-**
    - Vacuum hoses for connection diagram. See **VACUUM HOSE CONNECTION DIAGRAM** .

Fig. 2: Exploded View Of Variable Intake Manifold
Courtesy of VOLKSWAGEN OF AMERICA, INC.

VARIABLE INTAKE MANIFOLD, DISASSEMBLING AND ASSEMBLING

NOTE: To avoid distortion of the variable intake manifold it must only be tightened in the described sequence:

- Remove variable intake manifold.
- Loosen connecting bolts.
- Disconnect upper and lower part of intake manifold. Separate both parts with light blows of a rubber headed hammer if necessary.
- Clean contact surface.
- Replace seal.
- Put upper and lower part of intake manifold together and tighten all connecting bolts hand-tight.
- Tighten all securing bolts in indicated sequence to 10 N.m.

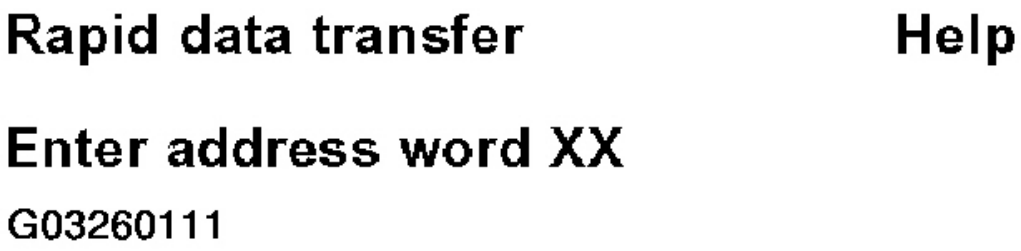

Fig. 3: Tightening Sequence Of Upper & Lower Intake Manifold Securing Bolts

Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Install variable intake manifold.

INJECTOR UNIT, SERVICING

- Observe rules for cleanliness. See **RULES FOR CLEANLINESS** .
- Always replace sealing and O-rings.

NOTE: The following list refers to items in Fig. 4 .

1. **20 N.m plus an additional 1/4 turn (90°)**
   - Always replace
   - Note sequence when loosening and tightening. See **INJECTOR UNIT, REMOVING AND INSTALLING** .
2. **Rocker shaft**
   - With rocker lever
   - Removing and installing, See **INJECTOR UNIT, REMOVING AND INSTALLING** .
3. **Lock nut, 30 N.m**
4. **Adjustment screw**
   - Replace when installing a new injector unit or if worn
   - Adjusting, see **INJECTOR UNIT, REMOVING AND INSTALLING**
5. **Unit injector**
   - Check ball pin for wear, replace if necessary
   - Removing and installing, see **INJECTOR UNIT, REMOVING AND INSTALLING**
6. **O-ring**
   - Replacing, See **O-RINGS FOR INJECTOR UNIT, REMOVING AND INSTALLING**
7. O-ring
   - Replacing, See **O-RINGS FOR INJECTOR UNIT, REMOVING AND INSTALLING**
8. **O-ring**
   - Replacing, See **O-RINGS FOR INJECTOR UNIT, REMOVING AND INSTALLING**
9. **Heat protection gasket**
   - Always replace
10. **Circlip**
11. **Cylinder head**
12. **Scotch block**
13. **12 N.m plus an additional 3/4 turn (270°)**
    - Always replace

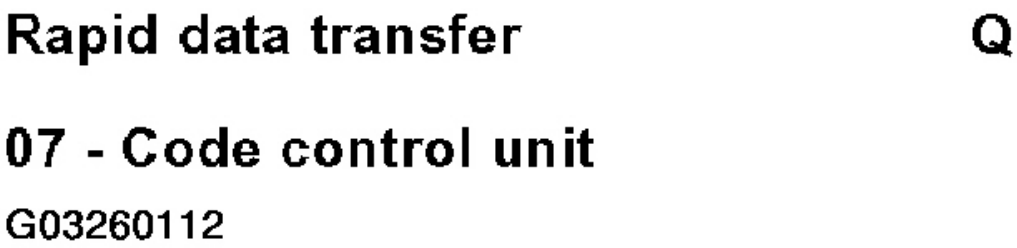

Fig. 4: Injector Unit Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

O-RINGS FOR INJECTOR UNIT, REMOVING AND INSTALLING

Special tools and equipment

- T10056 Assembly sleeves Removing

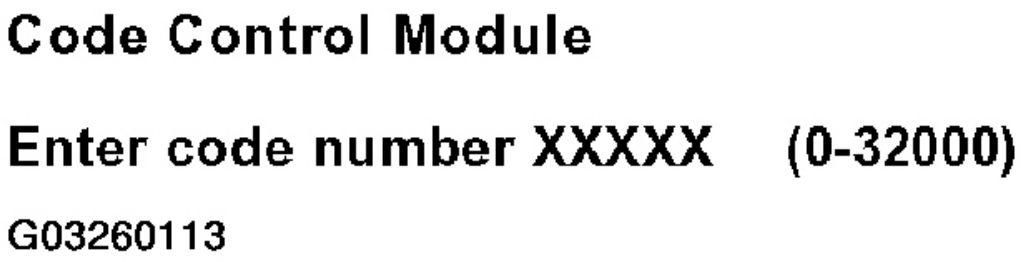

Fig. 5: Identifying T10056 Assembly Sleeves
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove injector unit, See **INJECTOR UNIT, REMOVING AND INSTALLING** .
- Carefully remove old O-rings from injector unit.

Installing

NOTE:

- **Always use assembly sleeves to install the O-rings. Otherwise the O-rings will be damaged.**

- **Gradual introduction of O-rings without different color identification. Observe correct application of the O-rings to the grooves: the ring thickness decreases towards the injector.**
- **Avoid rolling movements when sliding onto the O-rings. The O-rings must not be twisted in the injector unit seat.**

- Pull heat protection gasket off together with safety ring.
- Carefully clean contact surfaces for O-rings at injector unit.
- Install assembly sleeve T10056/1 on injector unit onto limit stop.

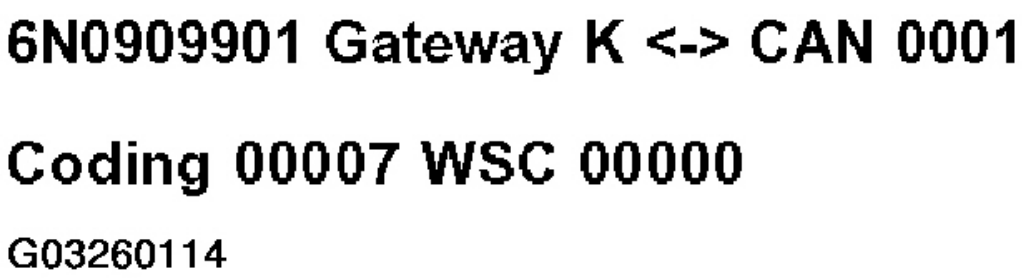

Fig. 6: Installing Assembly Sleeve T10056/1 On Injector Unit Onto Limit Stop
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Carefully slide upper thicker O-ring on assembly sleeve and in injector unit seat.
- Remove assembly sleeve.
- Install assembly sleeve T10056/2 on injector unit onto limit stop.
- Carefully slide center thinner O-ring on assembly sleeve and in injector unit seat.
- Remove assembly sleeve.

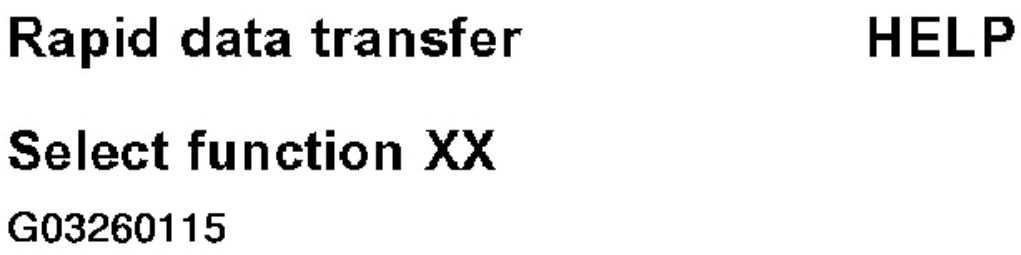

Fig. 7: Installing Assembly Sleeve T10056/2 On Injector Unit Onto Limit Stop
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Install assembly sleeve T10056/3 on injector unit onto limit stop.

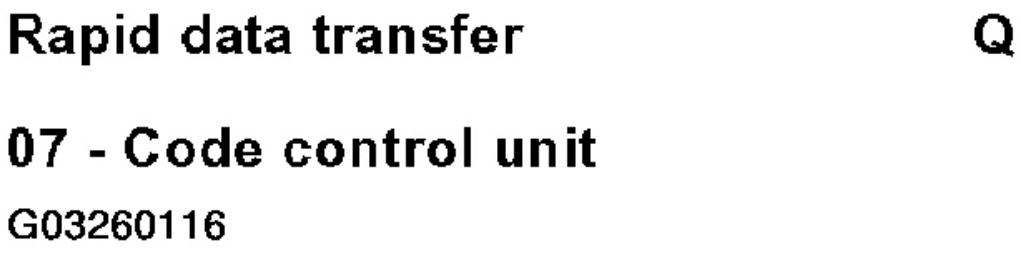

Fig. 8: Installing Assembly Sleeve T10056/3 On Injector Unit Onto Limit Stop
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Carefully slide lower O-ring on assembly sleeve and in injector unit seat.
- Remove assembly sleeve.
- Slide on a new heat protection gasket together with safety ring.
- Install injector unit, See **INJECTOR UNIT, REMOVING AND INSTALLING** .

INJECTOR UNIT, REMOVING AND INSTALLING

Special tools and equipment

- VW 387 Universal dial gauge bracket
- 3410 Socket

- T10054 Socket
- T10055 Puller
- V.A.G1331 Torque wrench (5 to 50 N.m)
- Dial gauge

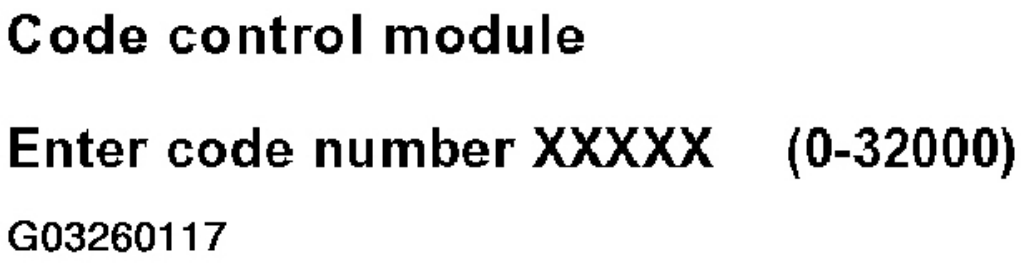

Fig. 9: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

- Remove toothed belt upper part and cylinder head cover. See **CYLINDER HEAD, REMOVING AND INSTALLING** .
- Turn crankshaft until cam pair of injector unit to be installed/removed points evenly upward.
- Loosen adjustment screw lock nuts -1- and unscrew adjustment screws until respective locker lever lies on injector unit spring. See **Fig. 10** .
- Loosen securing bolts -2- for rocker shaft (starting on outside and working inward) with socket insert 3410 and take rocker shaft off.
- Loosen scotch block securing bolt -3- with socket insert T10054 and remove scotch block.

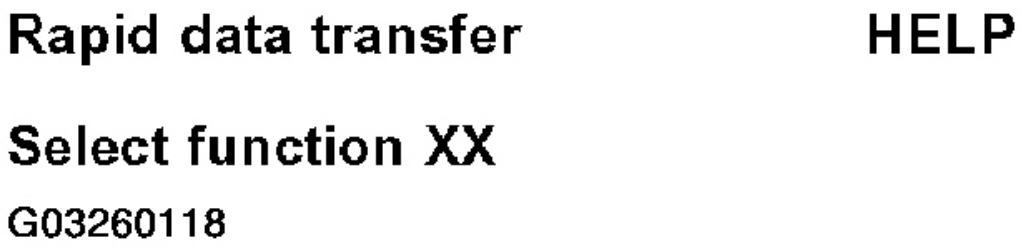

Fig. 10: Removing Scotch Block
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Pry up unit injector connector with a screwdriver. To avoid canting support other side of connector with light finger pressure.

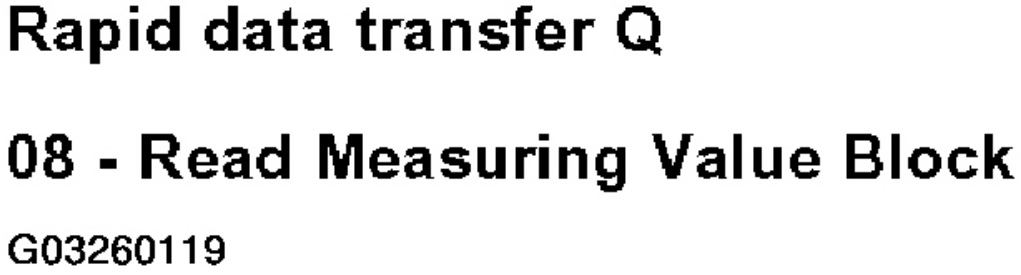

Fig. 11: Prying Up Unit Injector Connector With Screwdriver
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Insert puller instead of scotch block into slot of injector unit.
- Pull injector unit off by knocking it outward of cylinder head seat.

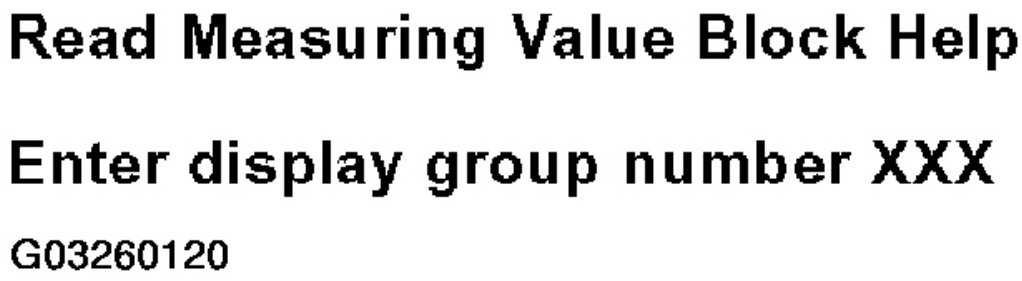

Fig. 12: Removing Injector Unit
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

NOTE:

- **If a new injector unit is installed, the respective adjustment screw in the rocker lever must also be replaced.**
- **For every repair which requires an adjustment of the injector unit, the locker lever adjustment screw and the injector unit ball pin must be cleaned and checked for wear. If worn replace the ball pin and adjustment screw.**
- **New injector units are supplied with O-rings and heat protection gasket.**

If the old injector unit is installed, the O-rings and heat protection gasket must be replaced, See **O-RINGS FOR INJECTOR UNIT, REMOVING AND INSTALLING** .

- Check correct seat of three O-rings, heat protection gasket and safety ring before installing injector unit.

NOTE: **The O-rings must not be twisted.**

- Oil O-rings and insert injector unit with greatest care in cylinder head seat.
- Install injector unit into cylinder head seat onto limit stop by pressing it evenly.
- Insert scotch block into slot of injector unit.

NOTE: **If the injector unit is not positioned at right angles to the scotch block the securing bolt could loosen and cause damage to the injector unit or the cylinder head.**

Align injector unit as follows:

- Screw new securing bolt into scotch block until injector unit can still be turned lightly.
- Align injector unit at right angles to bearing pedestals of camshaft.
- Use a vernier gauge (measuring range at least 400 mm) and check dimension "a" from cylinder head outer edge to round surface of injector unit. See **Fig. 13** and **DIMENSION "A" FROM CYLINDER HEAD OUTER EDGE TO ROUND SURFACE OF INJECTOR UNIT** .

DIMENSION "A" FROM CYLINDER HEAD OUTER EDGE TO ROUND SURFACE OF INJECTOR UNIT

Cylinder	Dimension "a"
1	333.0 +/-0.8 mm
2	245.0 +/-0.8 mm
3	153.6 +/-0.8 mm
4	65.6 +/-0.8 mm

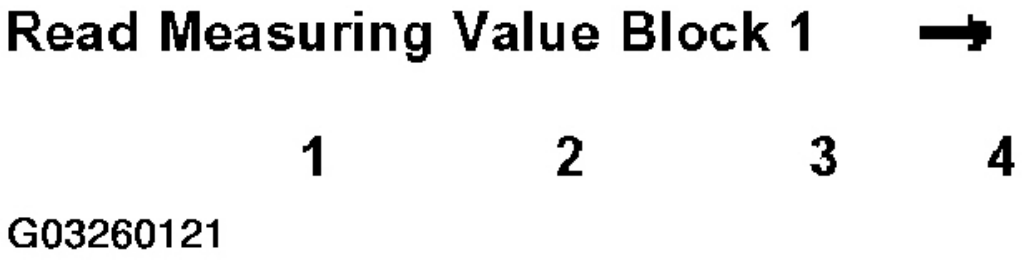

Fig. 13: Checking Dimension "a" From Cylinder Head Outer Edge To Round Surface Of Injector Unit
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Align injector unit again, if necessary, and tighten securing bolt as follows:
- Tighten securing bolt to 12 N.m plus an additional 270° (3/4 turn). Turning further can be done in several stages.
- Position rocker shaft and tighten new securing bolts as follows:

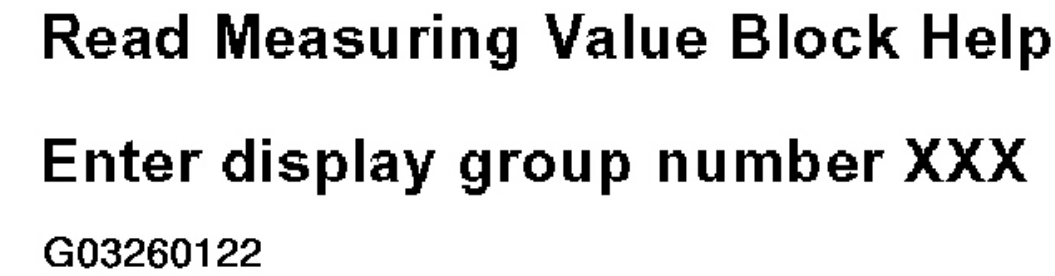

Fig. 14: Positioning Rocker Shaft And Tightening New Securing Bolts
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Tighten inner bolts -2- first and then outer screws -1- hand-tight. Then in same sequence to:

  20 N.m and 90°(1/4 turn further).

- Install a dial gauge on injector unit adjustment screw as shown in **Fig. 15** .

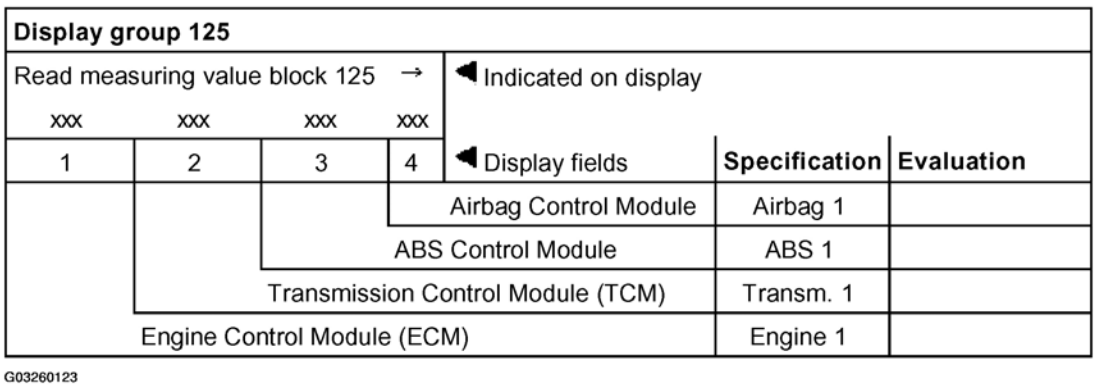

Fig. 15: Installing Dial Gauge On Injector Unit Adjustment Screw
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Turn crankshaft in engine direction of rotation, until rocker lever roller is positioned on actuating cam point.

  Roller side (arrow -A-) is at highest point

  Dial gauge (arrow -B-) is at lowest point

- Remove dial gauge.

- Install adjustment screw into rocker lever until a considerable resistance can be felt (injector element is onto limit stop).
- Turn adjustment screw back from top around 225°.
- Hold adjustment screw in this position and tighten lock nut to 30 N.m.

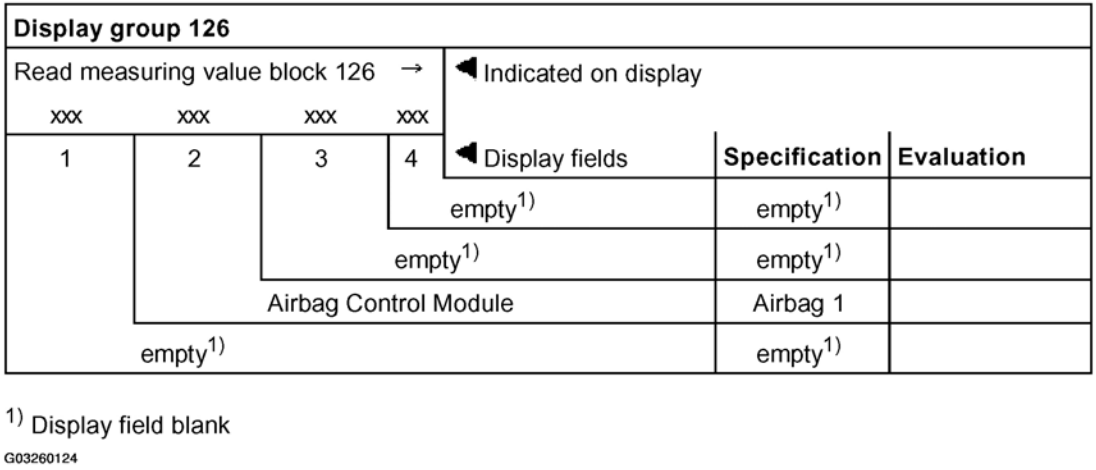

Fig. 16: Holding Adjustment Screw In Position And Tightening Lock Nut
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Position injector unit connector and install cylinder head cover and toothed belt guard, upper part. See **CYLINDER HEAD, REMOVING AND INSTALLING** .

ENGINE CONTROL MODULE

ENGINE CONTROL MODULE, REMOVING AND INSTALLING

- Before removing engine control module check control module identification and thereby previous control module coding, See **ENGINE CONTROL MODULE (DTC) MEMORY, READING AND ERASING** .

Removing

- Switch ignition off.
- Remove inner cover on left hand side of plenum chamber.

  See **PLENUM CHAMBER INNER COVER, REMOVING AND INSTALLING** .

- Carefully press off retaining tab (arrow).

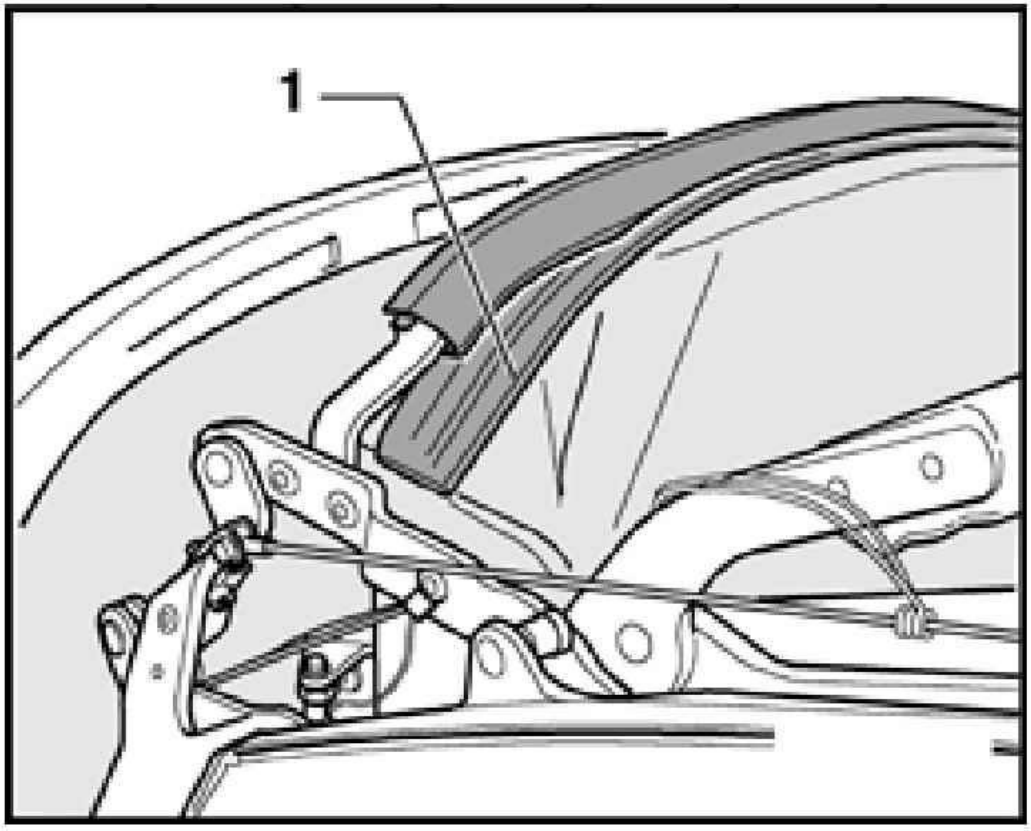

Fig. 17: Pressing Off Engine Control Module Retaining Tab
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Unlock engine control module connector and remove.

Installing

- Install new control module and press to left.
- Connect connector and lock in position.
- Check previous coding and code new control module, See **COMPONENTS, ADAPTING** .

ENGINE CONTROL MODULE (DTC) MEMORY, READING AND ERASING

Special tools and equipment

- VAS 5051 Vehicle Diagnosis, Testing and Information System

- Diagnostic cable VAS 5051/1 or VAS 5051/3

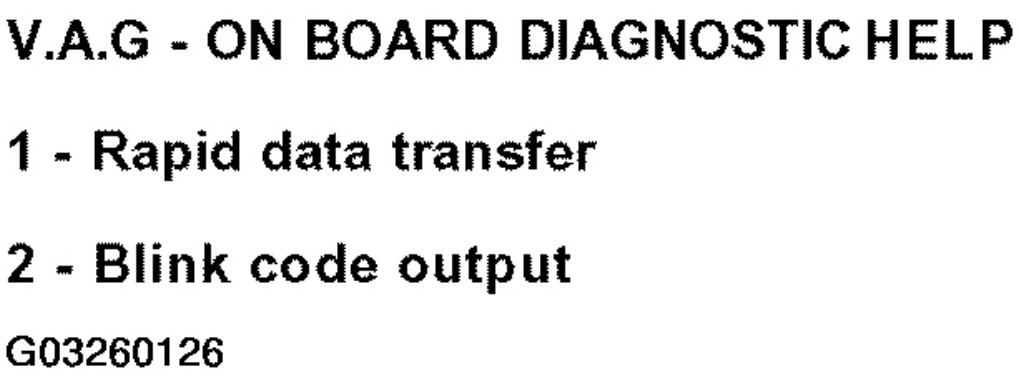

Fig. 18: Identifying VAS 5051 Vehicle Diagnosis, Testing And Information System
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Work sequence

Connect Vehicle Diagnosis, Testing and Information System VAS 5051 as follows:

- Connect connector of diagnosis cable VAS 5051/1 or VAS 5051/3 to diagnosis connection.

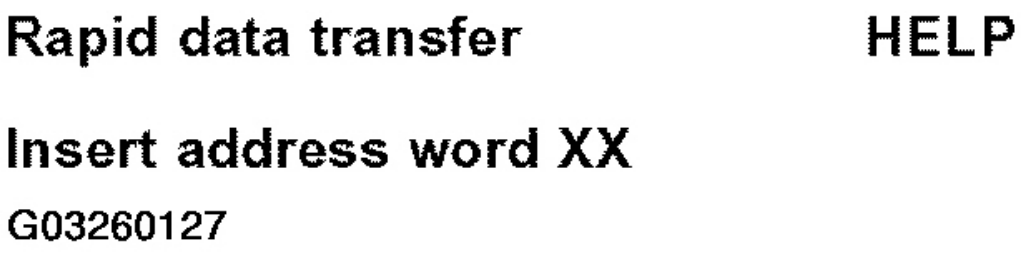

Fig. 19: Connecting Connector Of Diagnosis Cable VAS 5051/1 Or VAS 5051/3 To Diagnosis Connection
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Start engine and run at idling speed.

NOTE: Only when engine does not start:

- Switch ignition on.

Select operating mode

- Press button on screen for "Vehicle self-diagnosis".

Select vehicle system

- Press button "01 - Engine electronics" on screen.

The control module identification and engine control module coding are shown on the screen.

Select diagnostic function

- Press button "02 - Interrogating fault memory" on screen.

  "No fault detected" appears on screen if no DTCs are stored in the engine control module.

If DTCs are stored in the engine control module they will appear on the screen listed one below the other.

- Press <-- button.
- Press button "05 - Erase fault memory" on screen.
- Press function 06-"End output".

COMPONENTS, ADAPTING

Special tools and equipment

- VAS 5051 Vehicle Diagnosis, Testing and Information System
- Diagnostic cable VAS 5051/1 or VAS 5051/3

Fig. 20: Identifying VAS 5051 Vehicle Diagnosis, Testing And Information System
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Select "guided fault finding" in the VAS 5051 tester.

After all control modules have been interrogated:

- Press "Go to" button
- Select "Function/component selection"
- Select "drivetrain"
- Select "engine code"
- "01 Select "01-Systems capable of self-diagnosis"
- Select "engine management system"
- Select "Functions"
- Select "Function or component"